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A Minimal Metaphysics for Scientific Practice

Andreas Hüttemann

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Unpacking the title of this book, Hüttemann's aim is to establish a metaphysics for scientific practice in the sense of 'making explicit assumptions concerning the structure of reality that best explain the success of [that] practice' (p. 1). Furthermore, this metaphysics should be minimal in that 'it should contain no assumption that does not do any work in explaining scientific practice' (p. 11). Hüttemann focuses on three issues that he sees as central to the scientific enterprise: laws, causation, and reduction.

Starting with laws, it is crucial for Hüttemann's overall minimal metaphysics that laws apply to systems (where he emphasizes in a footnote that nothing much hinges on this term and that 'thing' or 'object' would do just as well; p. 13, Footnote 3). As he says, talk of 'systems' and their behaviour is ubiquitous in scientific practice and he takes this notion to be metaphysically neutral when it comes to issues of fundamentality, indivisibility, and so on. Thus, laws constrain the behaviour of systems and that ability is understood as a manifestation of natural necessity, which 'can be explicated in terms of the fact that they are invariant with respect to a number of different kinds of circumstances' (p. 23). Of course, invariance is also a modal notion but the attempt to reduce such notions to non-modal facts would be to go beneath the modal 'surface structure', which is all that a 'minimal metaphysics' should be concerned with.

The claim that law statements imply invariance claims is, Hüttemann argues, supported by scientific practice which distinguishes laws from accidental generalizations, in that the former, but not the latter, state relations that are invariant in a number of respects (pp. 31–33). Specifically, they may be invariant with respect to the initial conditions, certain features of the system concerned, and the behaviour of other systems. It is in the context of this last respect that *ceteris paribus* (cp) clauses are introduced in order to accommodate a failure in the relevant invariance.

The nature and role of such clauses are the topic of Chapter 2, where Hüttemann considers two central issues: the 'semantic problem', which concerns the truth conditions for cp laws, and the 'confirmation problem', which has to do with how they are (or are not) confirmed (p. 44). Drawing on the relevant literature, including his own work, Hüttemann argues that both problems can be dealt with if we understand laws as attributing certain dispositions to systems (pp. 74–81). However, he declines to articulate this notion further, in accordance with his aim of articulating a minimal metaphysics only, leaving the reader to wonder whether his account can really embrace both the case of an electron going one way or another in a magnetic field and that of a vase breaking when struck.

At the heart of his argument lies an application of inference to the best explanation: it is this minimal dispositionalism that best explains 'extrapolation', which is that aspect of scientific practice whereby certain generalizations that hold under specific circumstances are also found to hold under other circumstances. A semantics for cp-law statements is then obtained, since such a statement is true 'provided the type of system has the disposition that the cp-law statement attributes to it' (p. 65). The problem of (dis)confirmation also dissolves as long as epistemically acceptable cp laws can be 'embedded in an experimental and/or theoretical methodology that allows us to determine the influence of the interfering factors' (p. 67).

Crucially, invariance claims can be scientifically investigated and, Hüttemann maintains, they are all we need to account for (almost) all the 'natural modalities' to be found in scientific practice.

Thus, in Chapter 3 he argues that we do not need to extend or otherwise elaborate on this minimal framework in order to understand our causal practices. More specifically, the relevant dispositions underpin what he terms the 'quasi-inertial' behaviour of systems, where this refers to the way such systems continue to behave as long as they are not interfered with (pp. 90–92). This, in turn, explains our practices of identifying the actual causes of phenomena, which can be understood in terms of the factors that disrupt this behaviour. As Hüttemann notes, there are similarities here to processual as well as dispositional approaches to causation. With regard to the former, however, for a process to be quasi-inertial it is not necessary for conserved or invariant properties to be involved (pp. 98–100). As for the latter, here he is rather quick, noting simply that whereas Anjum and Mumford, for example, take a cause to be a disposition manifesting itself, on his account causes have to do with factors that interfere with a disposition manifesting itself (quasi-inertially).

This account is then put to work in Chapter 4 in dealing with issues to do with pre-emption and transitivity. In the former case, our intuitions can be accommodated through the incorporation of a 'minimality constraint' on the relevant interfering factors (pp. 116–88). When it comes to the latter, the question whether transitivity holds can be answered by determining whether the relevant process that is disposed to quasi-inertial behaviour can be constructed or not (pp. 122–25). The chapter ends with a brief consideration of how this account can be related to recent work in causal modelling (pp. 127–29).

In the final three substantive chapters the focus shifts to practices of reduction and the issue of the ontological commitments they entail. Chapter 5 examines the questions of, first, how these practices should be characterized and, second, why we might be interested in them. Thus, the first half is spent disentangling part-whole explanations from theory reduction more generally, where 'limit-case' reduction is in turn distinguished from 'Nagel reduction', in which the old theory is taken to be embeddable entirely in the new. Part-whole explanations, on the other hand, need not invoke theories at all (p. 140), particularly in the non-physical sciences. Interestingly, Hüttemann argues that failures of such explanations—as in the case of protein-folding in molecular biology—should be regarded as anomalies and indicative of the fact that we take it to be a regulative principle in scientific practice to search for these kinds of explanations. Furthermore, he argues, we are interested in these forms of reduction because 'we aim at understanding how different accounts of one and the same system can simultaneously lead to successful predictions, manipulations, etc.' (p. 131). Given all this, Hüttemann continues, there is no need to assume any further metaphysical hypotheses, such as foundationalism or eliminativism, in order to make sense of why we are interested in these practices in the first place (pp. 156–58).

This last point is pursued over the next two chapters. Chapter 6 presents an examination of the extent to which the success of such reductive practices commits us to foundationalism. Spoiler alert: it doesn't! If foundationalism were true, Hüttemann argues, then we would need to introduce into our metaphysics further relations beyond the nomological connections or invariances discussed above, and which should be asymmetric and non-modal. However, he concludes, our explanatory practices do not imply any such further relations. Of course, the asymmetry of physical part-whole explanations suggests a number of possible counter-examples here but Hüttemann outsources the further element in such cases to pragmatic concerns, having to do with our desire to manipulate certain factors rather than others (pp. 174–75). This may be plausible in the case of causal explanations but it seems less so in the part-whole case, and Hüttemann's appeal to the example of an electronic network in this context is unconvincing.

One might seek to escape the metaphysical mire by opting for eliminativism. However, in Chapter 7, Hüttemann rejects the well-known causal overdetermination arguments for this position on the grounds that his disposition-based process theory of causation accommodates the attribution of causal relations to both micro- and macro-based behaviour (pp. 188–93). Nevertheless, he does acknowledge that although our practices do not commit us to this view, it might still seem to provide a good explanation of certain aspects of these practices. A much-used example here would be Eddington's (in)famous 'two tables' argument, where it is concluded that only the one table is real, namely, that which is described in terms of physics. According to Hüttemann, however, eliminativism is not the only explanation for what is going on and, indeed, a better one is provided by 'ontologically neutral monism', which accepts there is ultimately only one kind or level of fact/entity/event but declines to make any positive claim about the nature of such (pp. 195–99). Coupled with a form of 'descriptive pluralism' that allows for multiple representations of a system, none of which is ontologically privileged as the true account, this allows us to accept both a description of the table in terms of quantum mechanics and one in which the table is individuated as a functionally defined, everyday object (p. 202). Of course, there may be a tension in this coupling insofar as the minimal metaphysics here is supposed to be supported by our scientific, as opposed to everyday, practices. And relatedly, one might wonder to what extent one can remain ontologically neutral in the face of such practices. Indeed, granted that 'there is no "remorseless logic" that forces us to conclude that fundamental physics gives us *the only* true story of the world' (p. 198), what other story do we have when it comes to accounting for the solidity of the table, for example?

In the final chapter, Hüttemann situates his account among recent work in the metaphysics of science and, in particular, the debate over whether inference to the best explanation, as deployed throughout the book, is an appropriate device to use here. 'Ontological neutral monism', for example, is presented as the 'best' position to adopt because it is more parsimonious, since it does not commit itself to the relevant facts/entities/events having a 'fundamental-physical' (sic)

nature (p. 213). But, of course, this parsimony is bought at the cost of a lack of specificity and it could be argued that the best explanation should be one that nails its colours to the mast. More generally, if inferences to the best explanation in science are epistemically risky, for all the well-known reasons, they are surely even more so in metaphysics, where underdetermination is much more prevalent.

Finally, Hüttemann also considers whether his view counts as naturalized metaphysics or not, and concludes that 'a minimal metaphysics of scientific practice takes metaphysical issues seriously whether or not they promote natural science' (p. 216). Given the burgeoning literature on this topic one might have expected a little more here, not least on why we should take some of the more outré excursions into modal metaphysics seriously at all. But, of course, no book can cover everything and this one does tackle a number of significant issues in an engaging and philosophically sophisticated way. Unfortunately, it doesn't treat the practices in quite the same manner. Many of the cases involve 'toy' examples (frankly, I think billiard balls should be banned from discussion of causation henceforth, along with Sally and her rock!) and most are physics-based. This is a little surprising given that, in response to Russell's rejection of causality in physics, Hüttemann admits that his disruptive account might be restricted to the macroscopic context. This offers an open door to a broader reflection on causation as it features in a wide range of practices, but the opportunity is not taken up.

Having said that, there's still a lot to get one's teeth into and on the basis of the practices of the Leeds philosophy of science reading group, this book will certainly generate considerable discussion.¹

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Notes

¹ Many thanks to the members of this group for that discussion, including Marina Baldiserra Paccheti, Douglas Earl, Simon Graf, Yihan Jiang, Colin McCullough-Benner, and especially to Callum Duguid and Juha Saatsi for their helpful remarks.